

CLAIMS

What is claimed is:

1. A process for creating an acoustically absorbent porous panel comprising the steps of:

dispensing and conveying dry cement;

dispensing and conveying dry fibrous material;

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aqueous mixing water, surfactant and air to create a foam;

combining and mixing the foam and dry ingredients to form a foamed cementitious material comprising on a wet basis about 53% to about 68% by weight cement, about 17% to about 48% by weight water, about 0.05% to about 5% by weight fibers, and about 0.01% to about 10% by weight surfactant; and

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drying the foamed cementitious material.

2. The process of claim 1, further including regulating the temperature of the aqueous mixture to a temperature between about 41° F to about 168° F.

3. The process of claim 2, wherein the aqueous mixture is regulated to a temperature of between about 68° F to about 100° F.

4. The process of claim 1, wherein the process includes dry mixing cement and fibers to create a dry mix.

5. The process of claim 1, wherein the process is continuous and uses a conveyor.

6. The process of claim 5, further including dispensing the foamed cementitious material onto the conveyor.

7. The process of claim 6, further including gauging the thickness of the foamed cementitious material.

8. The process of claim 7, wherein the thickness of the foamed cementitious material is gauged to least 0.25 inches.

9. The process of claim 1, further including texturing the foamed cementitious material.

10. The process of claim 1, further including cutting the panel.

11. The process of claim 1, wherein the foamed cementitious material is dried to at least 5% or less moisture.

12. The process of claim 1, further including forming a dense skin on both a facing side and backing side of the panel wherein the dense skin comprises less than about 2% of the total thickness of the panel.

13. The process of claim 12, wherein the skin is between about 125 μm to about 250 μm thick.

14. The process of claim 12, further including the step of removing the dense skin of the facing side of the panel.

15. The process of claim 14, wherein the step of removing the dense skin of the facing side includes sanding.

16. The process of claim 12, further including the step of applying an organic coating to the facing side of the panel.

17. The process of claim 1, further including adding calcium silicate to the dry mix.

18. The process of claim 17, wherein the calcium silicate comprises about 1% to about 10% by weight of the foamed cementitious material.

19. The process of claim 1, further including forming pores within the foamed cementitious material.

20. The process of claim 19, wherein the diameter of the pores is between about 1.5mm and about 40 μ m.

21. The process of claim 20, wherein the pores have an average diameter from about 50 μ m to about 200 μ m.

22. The process of claim 19, wherein the pores are open to other pores creating pathways through the cementitious material whereby sound can be effectively absorbed.

23. The process of claim 1, wherein the dried foamed cementitious material has a density between 10 lbs/ft³ and about 40 lbs/ft³.

24. The process of claim 1, wherein the panel is an acoustic ceiling tile.

25. The process of claim 1, wherein a Noise Reduction Coefficient of the panel is at least 0.5.

26. The process of claim 25, wherein the Noise Reduction Coefficient of the panel is at least 0.7.

27. The process of claim 1, wherein the range for a Sound Transmission Coefficient is between about 30 to about 40.

28. The process of claim 1, wherein the cement is selected from the group consisting of portland, gypsum, sorrel, slag, fly ash, and calcium alumina cement.
29. A process for creating acoustical ceiling panels comprising the steps of:
 - dry mixing cement, and fibers to create a dry mix;
 - aqueous mixing water and surfactant to create a diluted surfactant solution;
 - combining and mixing the diluted surfactant solution, air and dry mix to create a foamed cementitious material; and
 - drying the foamed cementitious material to form an absorbent porous panel having a density between about 10 and 40 lb/ft³, a Hess rake finger scratch test result of at least 12, a Noise Reduction Coefficient of at least 0.5, and a sag test result of less than 0.15 inches at 90% RH.
30. The process of claim 29, wherein the cement is gypsum.
31. The process of claim 29, further including adding calcium silicate to the dry mix.
32. The process of claim 29, wherein the fibers are polyester fibers.

33. A process for creating acoustical ceiling panels comprising the steps of:

dry mixing cement and synthetic organic fibers to create a dry mix;

5 aqueous mixing water and surfactant to create a diluted surfactant solution;

combining and mixing the diluted surfactant solution and dry mix to form a foamed cementitious material comprising on a wet basis about 56% to about 61% by weight cement, about 32% to about 10 42% by weight water, about 0.28% to about 1.3% by weight fibers, and about 0.7% to about 2% by weight surfactant; and

drying the foamed cementitious material.

34. A process for creating an acoustically absorbent porous panel comprising the steps of:

dispensing and conveying dry cement;

dispensing and conveying dry fibrous material;

5 aqueous mixing water, surfactant and air to create a foam;

combining and mixing the foam and dry ingredients to form a foamed cementitious material comprising cement, water, fibers, and surfactant;

drying the foamed cementitious material; and

texturing the dried foamed cementitious material.

35. An apparatus for creating an acoustically absorbent porous panel comprising:

a dispenser for conveying a cement;

a dispenser for conveying fibrous material;

5 an aqueous mixer for mixing water, surfactant and air to create a foam;

10 a combining mixer for combining and mixing the foam, cement and fibrous material to form a foamed cementitious material comprising on a wet basis about 53% to about 68% by weight cement, about 17% to about 48% by weight water, about 0.05% to about 5% by weight fibers, and about 0.01% to about 10% by weight surfactant; and

a drying chamber for drying the foamed cementitious material.

36. The apparatus of claim 35, further including a temperature regulator for regulating the temperature of the diluted surfactant solution to a temperature between about 41° F to about 168° F.

37. The apparatus of claim 36, wherein the diluted surfactant solution is regulated to a temperature of between about 68° F and about 92° F.

38. The apparatus of claim 35, further including a dry mixer for mixing cement and fibrous material to create a dry mix.

39. The apparatus of claim 35, further including a conveyor receiving the foamed cementitious material.

40. The apparatus of claim 39, further including a dispenser for dispensing the foamed cementitious material onto the conveyor.

41. The apparatus of claim 35, further including a gauging roller for gauging the thickness of the foamed cementitious material on the conveyor.

42. The apparatus of claim 35, further including an embossing roller for texturing the foamed cementitious material.

43. The apparatus of claim 35, further including a cutter for cutting the panel.

44. The apparatus of claim 35, further including a dryer for drying the foamed cementitious material to 5% or less by weight of moisture.

45. The apparatus of claim 35, further including a means for removing dense skin formed on a facing side of the panel.

46. The apparatus of claim 45, wherein the removing means is a sanding drum.

47. The apparatus of claim 35, further including a paint spraying apparatus for applying an organic coating to a facing side of the panel.

48. The apparatus of claim 35, wherein the cement is select from the group consisting of portland, gypsum, sorrel, slag, fly ash and calcium alumina cement, and mixtures thereof.

49. An apparatus for creating an acoustically absorbent porous panel comprising:

a dry mixer for dry mixing a cement and fibers to create a dry mix;

an aqueous mixer for aqueous mixing water, surfactant and air to create a foam;

a combining mixer for combining and mixing the foam and dry mix to form a foamed cementitious material comprising on a wet basis about 53% to about 68% by weight cement, about 17% to about 48% by weight water, about 0.05% to about 5% by weight fibers, and about 0.01% to about 10% by weight surfactant;

a conveyor receiving the foamed cementitious material; and

a drying chamber for drying the foamed cementitious material.

50. The apparatus of claim 49, further including a side-dam for restricting the foamed cementitious material to a constant overall width.

51. An apparatus for creating an acoustically absorbent porous panel comprising:

a dry mixer for dry mixing a cement and fibers to create a dry mix;

an aqueous mixer for aqueous mixing water, surfactant and air to create a foam;

a combining mixer for combining and mixing the foam and dry mix to form a foamed cementitious material; and

10 a drying chamber for drying the foamed cementitious material to form the absorbent porous panel having a density between about 10 lb/ft³ and about 40 lb/ft³, a scratch resistance test result of at least 12, a Noise Reduction Coefficient of at least 0.5, and a sag test result of less than 0.15 inches at 90% RH.

52. The apparatus of claim 51, wherein the foamed cementitious material comprises on a wet basis about 54% to about 63% by weight cement, about 32% to about 44% by weight water, about 0.1% to about 3% by weight fibers, and about 0.5% to about 5% by weight surfactant.

53. An apparatus for creating an acoustically absorbent porous panel comprising:

5 a dry mixer for dry mixing a cement and fibers to create a dry mix;

an aqueous mixer for aqueous mixing water, surfactant and air to create a foam;

10 a combining mixer for combining and mixing the foam and dry mix to form a foamed cementitious material comprising on a wet basis about 56% to about 61% by weight cement, about 32% to about 42% by weight water, about 0.28% to about 1.3% by weight fibers, and about 0.7% to about 2% by weight surfactant; and

a drying chamber for drying the foamed cementitious material.

54. The apparatus of claim 53, further including a conveyor receiving the foamed cementitious material.

55. The apparatus of claim 53, further including a gauging roller for gauging the thickness of the foamed cementitious material.

56. An apparatus for creating an acoustically absorbent porous panel comprising:

- a dispenser for conveying a cement;
- a dispenser for conveying fibrous material;
- 5 an aqueous mixer for mixing water, surfactant and air to create a foam;
- a combining mixer for combining and mixing the foam, cement and fibrous material to form a foamed cementitious;
- 10 a drying chamber for drying the foamed cementitious material; and
- texturing device for texturing the dried foamed cementitious material.

57. The apparatus of claim 56, wherein the texturing device is an embossing roller.